U.S. Department of Energy
Energy Efficiency and Renewable Energy

The President's Biofuels Initiative




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Office of the Biomass Program

Energy Efficiency and Renewable Energy

Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2001*
*Net fossil-fuel electrical imports
**Includes 0.2 quads of imported hydro
***Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

August 2003
Lawrence Livermore
National Laboratory
http://eed.llnl.gov/flow

President's Biofuels Initiative

Replace more than 75 percent of our oil imports from the Middle East by 2025

2012 Goal: Fund additional research in cutting-edge methods of producing ethanol, not just from corn, but from wood chips and stalks, or switch grass. **Our goal is to make this new kind of ethanol practical and competitive within six years!**

"America is addicted to oil"

The 30 X 30 Goal:

- Biofuels could meet up to 30 percent of our present fuel needs by 2030.
- Implement strategy during 2007 – 2012
  - Help industry build the first-of-a-kind plants
  - Cost share industrial-scale validation of technology and economics
  - Expand feedstock development efforts

Research in cutting-edge methods of producing ethanol

Our goal is to make this new kind of ethanol practical and competitive within six years

Hurdles to Overcome

- Fermentation Organism development (7 day/3 day)
- Yield of ethanol per ton of feedstock (65/90 gal/ton)
- Enzyme cost ($0.32/$0.10)
- Sugar recovery and conversion (Xylan to Xylose 63%/90%)

What the Initiative Provides

- Fermentation Organism Development solicitation
- ***Accelerated research on all major hurdles to $1.07 gal production cost***
- Leverage the results in converting corn stover to the broad variety of feedstocks

Feedstock Diversity

Producing ethanol not just from corn, but from wood chips and stalks, or switch grass

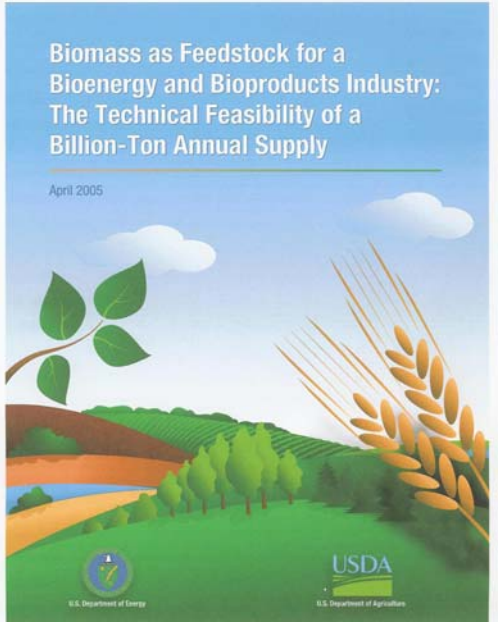
Hurdles to Overcome

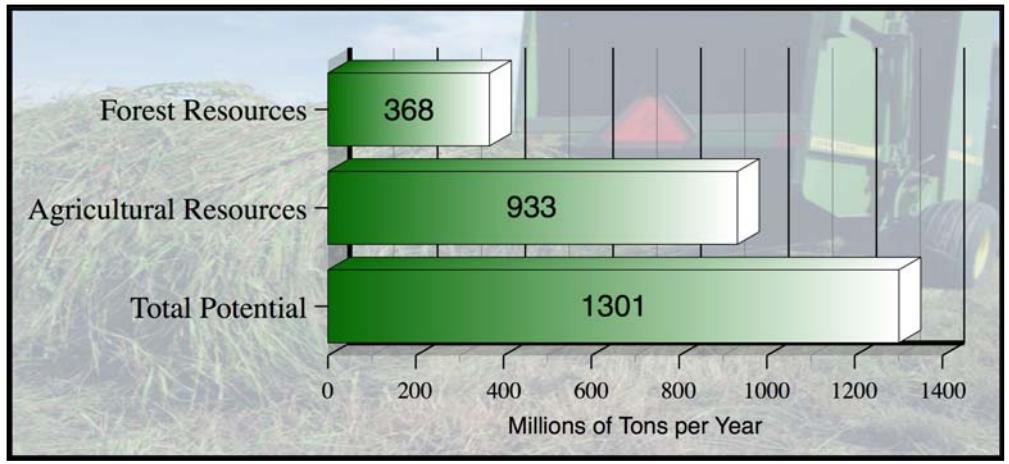
- Production of Ethanol from feedstocks available across the U.S.
- Lower the cost of feedstock from $53/$35
- Conversion Technology Options

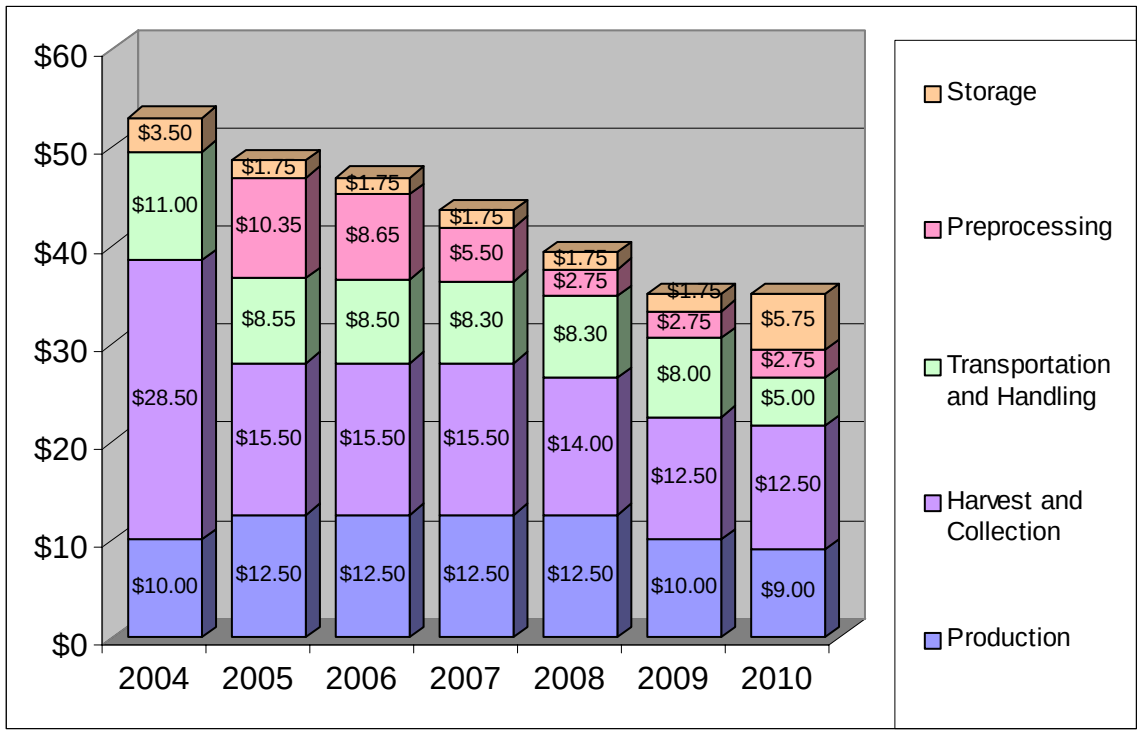
What the Initiative Provides

- Baseline for other feedstock beyond corn harvest residue (stover)
- Investigate the Conversion of a much broader number of possible feedstocks
- Develop regional feedstock partnerships to identify local opportunities for feedstock production and ethanol production
- Reestablish the Thermo-Chemical conversion technology as a second possible pathway to success

Conversion of Available Feedstocks







- "Billion Ton" study indicates that enough biomass is potentially available to displace > 30% of current U.S. petroleum consumption
- But it requires variety of biomass types
  - Agricultural lands
    - Corn stover, wheat straw, soybean residue, manure, switchgrass, poplar/willow energy crops, etc.
  - Forest lands
    - Forest thinnings, fuelwoods, logging residues, wood processing and paper mill residues, urban wood wastes, etc.

Pathways to Success

Fundamental R&D → **Development and Demonstration** → **Deployment**

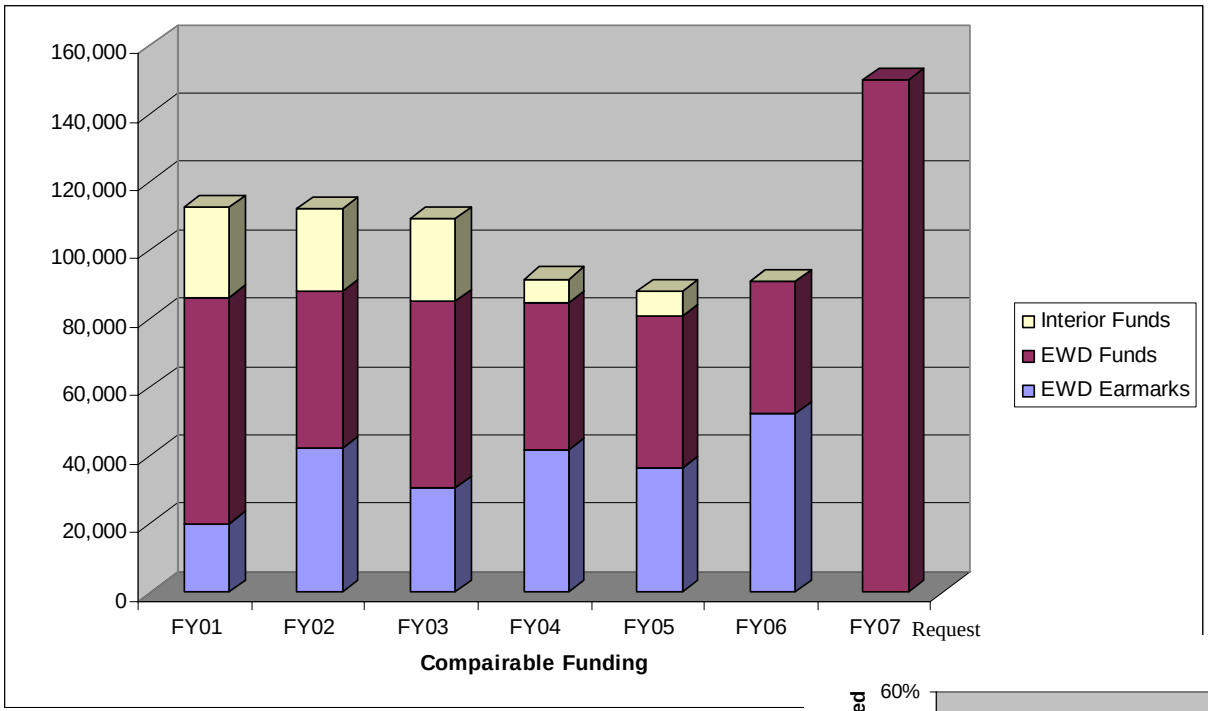
- Feedstock R&D
- Biochemical R&D
- Thermochemical R&D
- Products R&D
- Balance of Plant

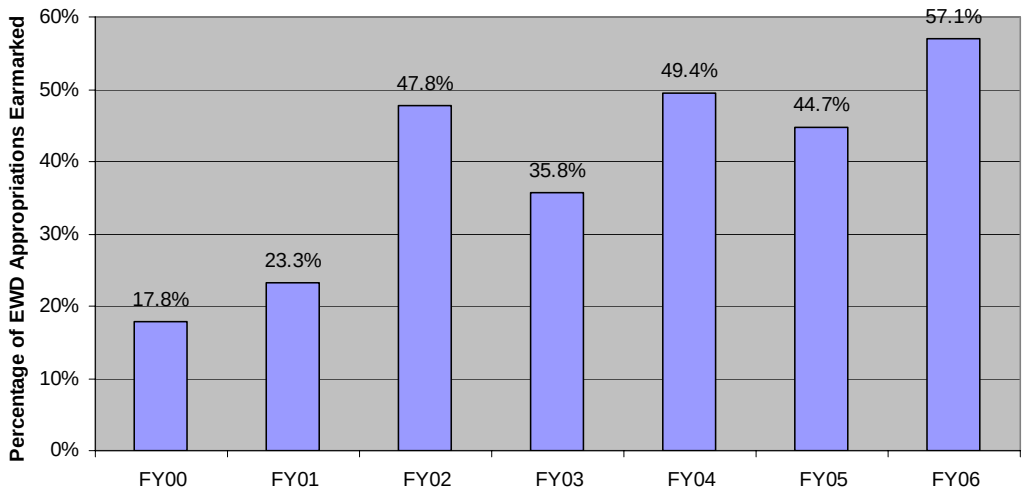
- Existing Wet & Dry Mill Improvements
- Oil Seed Mill Improvements
- Agricultural Residue Processing
- Pulp and Paper Mill Improvements
- Forest Residue Processing
- Perennial Energy Crops Processing

Integrated Biorefineries

Increasing Industry Participation

Funding & Earmark History





Biofuels Summary & Conclusions

- ✓ The only domestic & renewable option for liquid transportation fuels.
- ✓ Resource base sufficient to supply a large fraction of U.S. needs
- ✓ Building on advances in technology, including >10 fold reduction in enzyme costs
- ✓ Motivated industry
- ✓ Peak oil prices to motivate the public